US LHC Accelerator Research Program

brookhaven - fermilab - berkeley

Hardware Commissioning

Jim Strait

For the BNL-FNAL-LBNL LHC Accelerator Collaboration

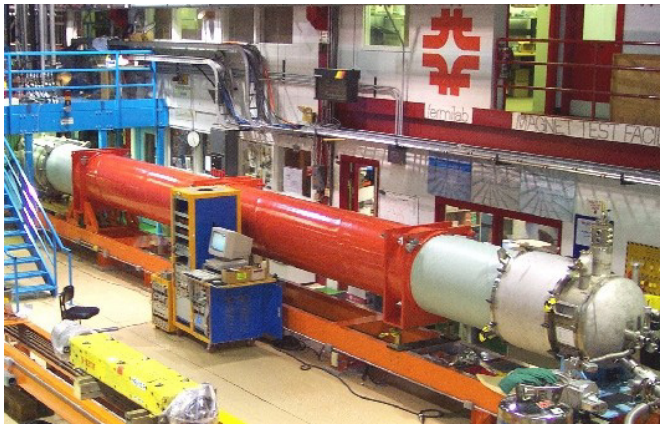
DOE Review

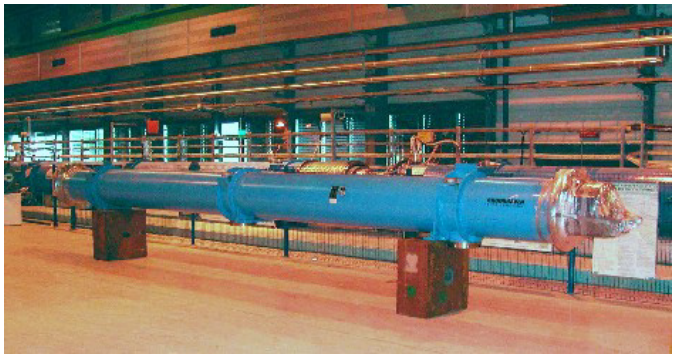
10 June 2003

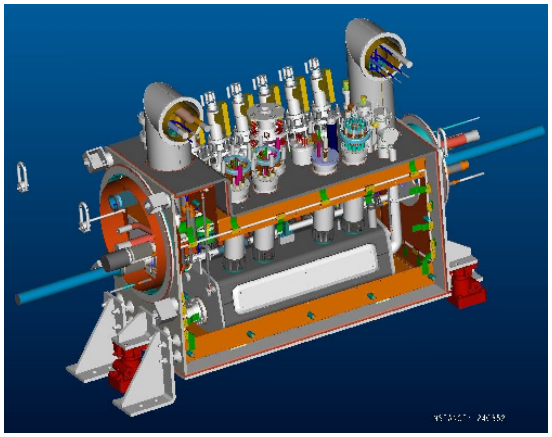
US-Provided Accelerator Equipment

Insertion Region Systems: Points 1, 2, 4, 5, 8

- US-built quadrupoles (FNAL)
- Japanese-built quadrupoles (KEK)
- CERN-provided correctors
- Cryostats for all quadrupole assemblies (FNAL)
- US-built beam separation dipoles (BNL)
- US-built IR feed boxes (LBNL)
- US-built specialized absorbers (LBNL)







Commissioning of US-Provided Hardware

The US LHC Accelerator (construction) Project did not anticipate nor include resources for involvement in commissioning of our equipment.

However, we need to be involved in the commissioning of our systems.

- It will speed the turn-on of the machine for HEP.
- We will get direct feed-back on the performance of our designs.
  - → The first system test of the inner triplets (and the first cold-test of the feedboxes) will be in the tunnel.
  - → The behavior with the large beam-induced heat load is important to understand, especially as we look towards 2nd generation IRs for a luminosity upgrade.
- The U.S. DOE Labs need to stand behind their products.
  - → Problems that arise during commissioning can best be solved with the participation of the experts who designed the equipment.

CERN
CH-1211 Geneva 23
Switzerland

the Large Hadron Collider project

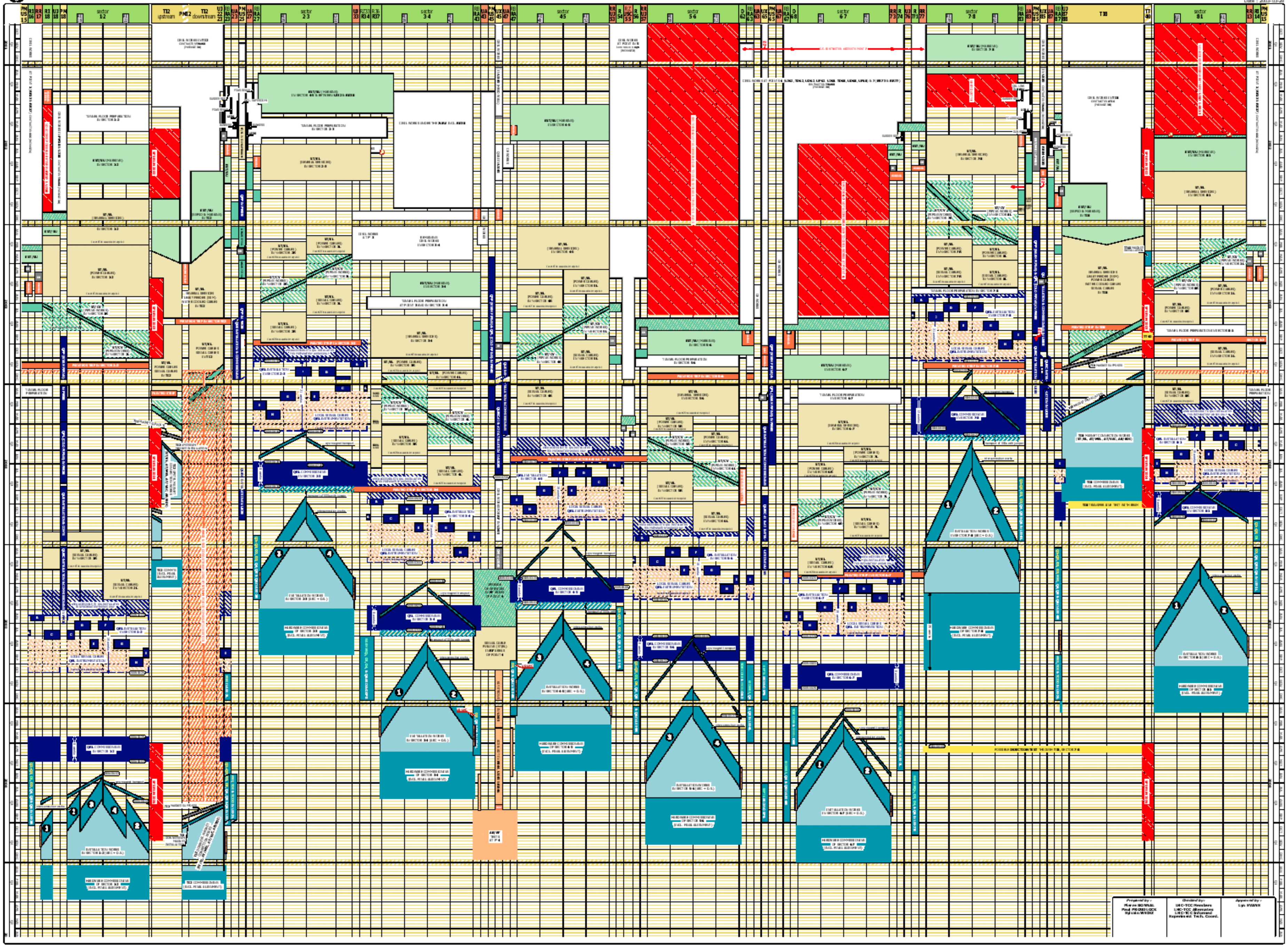
LHC Construction and Installation
General Co-ordination Schedule

LHC-PN-MS-0005 rev. 1.7

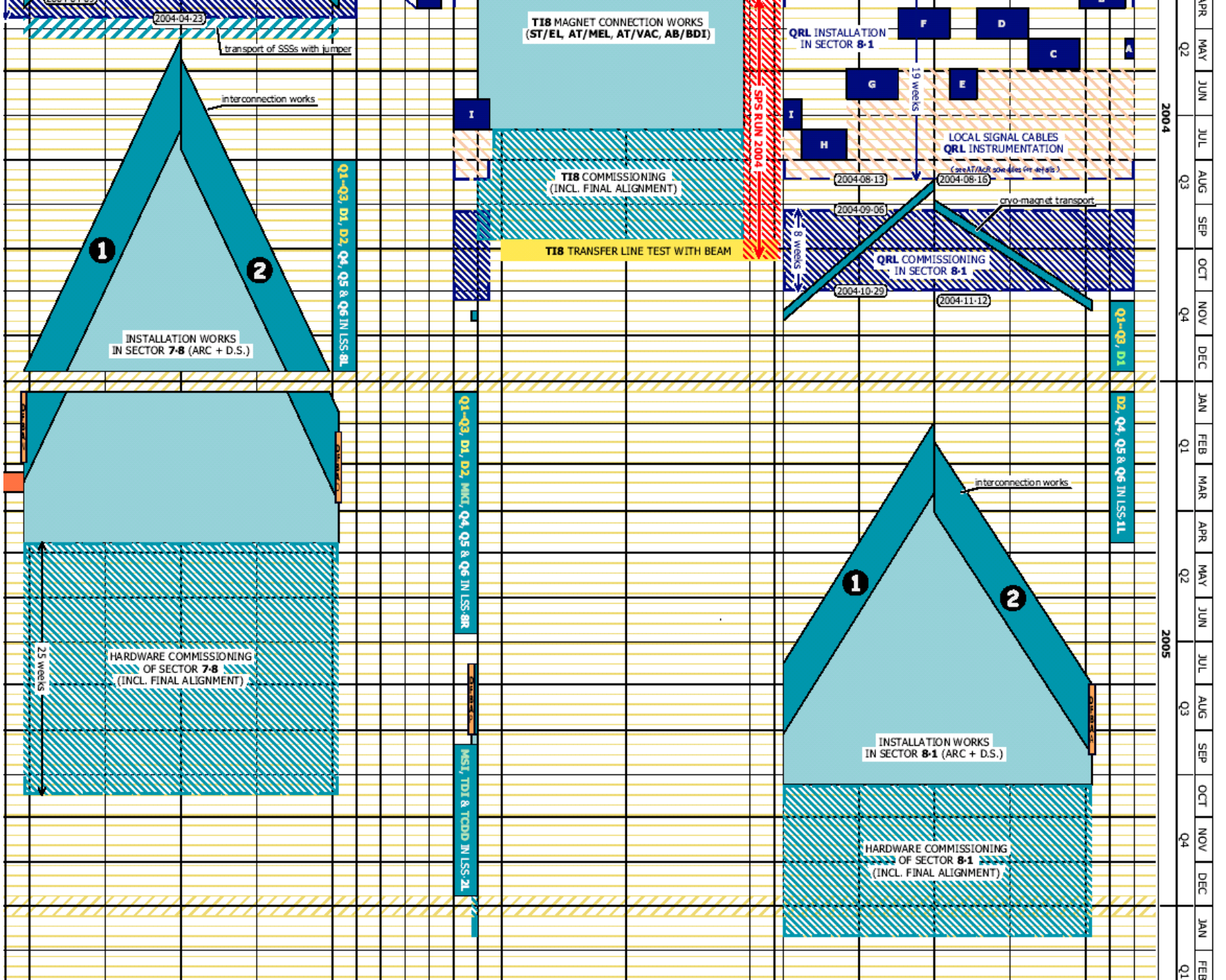
AC/TCP

102909

Date : 2003-03-28



Prepared by :	Checked by :	Approved by :
Pierre BONNAL Paul PROUDLOCK Sylvain WEISZ	LHC-TCC Members LHC-TCC Alternates LHC-TCC Informed Experiment Tech. Coord.	Lyn EVANS


2004-04-23
transport of SSSs with jumper
interconnection works
Q1-Q3, D1, D2, Q4, Q5 & Q6 IN LSS 8L
INSTALLATION WORKS IN SECTOR 7-8 (ARC + D.S.)
HARDWARE COMMISSIONING OF SECTOR 7-8 (INCL. FINAL ALIGNMENT)
25 weeks
TI8 MAGNET CONNECTION WORKS (ST/EL, AT/MEL, AT/VAC, AB/BDI)
SPS RUN 2004
TI8 COMMISSIONING (INCL. FINAL ALIGNMENT)
TI8 TRANSFER LINE TEST WITH BEAM
Q1-Q3, D1, D2, MKI, Q4, Q5 & Q6 IN LSS 8R
MSI, TDI & TCDD IN LSS 2L
QRL INSTALLATION IN SECTOR 8-1
19 weeks
LOCAL SIGNAL CABLES QRL INSTRUMENTATION
2004-08-13
2004-08-16
2004-09-06
cryo-magnet transport
8 weeks
QRL COMMISSIONING IN SECTOR 8-1
2004-10-29
2004-11-12
Q1-Q3, D1
D2, Q4, Q5 & Q6 IN LSS 1L
interconnection works
INSTALLATION WORKS IN SECTOR 8-1 (ARC + D.S.)
HARDWARE COMMISSIONING OF SECTOR 8-1 (INCL. FINAL ALIGNMENT)
2004
2005
Q2 APR MAY JUN
Q3 JUL AUG SEP
Q4 OCT NOV DEC
Q1 JAN FEB MAR
Q2 APR MAY JUN
Q3 JUL AUG SEP
Q4 OCT NOV DEC
Q1 JAN FEB

Hardware Commissioning Schedule

FY	Installation	Commissioning	Beam	Activity
2004	IR 8L			Planning
2005	IR 1L, 2R, 4R, 5L, 5R, 8R	IR2R, 8L		Hdw. Commissioning without beam.
2006	IR 1R, 2L, 4L	IR 1L, 4L, 4R, 5L, 5R, 8R	Injection Test (IR 8L and 8R)	Hdw. Commissioning + injection test.
2007		IR 1R, 2L	First Beam	System performance with Lum.
2008			$L > 10^{33}$	

- Modest effort by U.S. experts (~2 FTEs) will ensure that our equipment is integrated efficiently and that we learn about system performance.
- This will include a small on-site contingent to provide continuity and oversight, overlapping with shorter term assignments.
- A modest M&S budget will be provided to allow hardware issues uncovered during commissioning to be addressed.

Summary

- It is in our interest to participate in hardware commissioning of the U.S.-provided equipment and systems.
  - Help speed the machine start-up.
  - Direct feed-back on the performance of our designs.
    → Important for design of LHC upgrades and future hadron colliders.
- Planning must start NOW. (First CERN planning meeting on IR8 commissioning has just been held.)
- Work is most intense in FY2005-07.
- Modest effort continues until IR system performance is understood with significant beam heating => ~2008.